W. H. Bogdan
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Urban Mapping in Alberta, Canada.
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Urban Mapping in Alberta, Canada

Presented at the
Seventh International Conference on Cartography
May 1974 MADRID, SPAIN

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W. H. Bogdan
with indebtedness
to the staff of the Mapping office
for the preparation of the graphical display.

Urban Mapping

in

Alberta, Canada

Presented at the
Seventh International Conference on Cartography
May, 1974 MADRID, SPAIN

URBAN MAPPING in ALBERTA, CANADA

W. H. Bogdan

SUMMARY

An approach to large scale urban mapping in Alberta, a Province in western Canada with numerous urban municipalities, is described and illustrated through map samples and flow charts.

Basic scales are 1:1,000, 1:5,000 and 1:25,000 on the Transverse Mercator Projection.

Cartographic techniques such as Image Generation and Image Transformation are emphasized step by step from the cadastral manuscript to single and multi-colour maps. Highlighted is Image Modification, the flexibility of a system to produce economically, through various combinations and scale changes, derived maps in any form to satisfy the widest range of map users.

New approaches in line masking for cadastral-orthophoto combinations with contours are described, so are coding and the cutting of a single master-mask for multicolour maps, techniques applicable to medium and large scale mapping.

Given local requirements, the system has found considerable user interest and appears result oriented. Revisions are easily carried out. The system is capable of utilizing new materials and equipment, allows for variations in graphical requirement and greater computer assistance.

RÉSUMÉ

L'Alberta, province de l'Ouest canadien, compte plusieurs agglomérations urbaines importantes dont Edmonton, la capitale, et Calgary.

La facon réaliste avec laquelle le problème de la carte urbaine de détails fut abordé est décrit et illustré par de nombreux documents et à l'aide de plusieurs schémas de processus. Echelles de rédaction au 1:1000, 1:5000 et 1:25,000; projection Transverse Mercator Modifiée; techniques cartographiques permettant une bonne séparation d'éléments et une revision commode des planches depuis la maquette cadastrale jusqu'aux cartes thématiques polychromes qui en sont dérivées. Le système de production reste suffisamment flexible pour permettre une grande variété de combinés de nature à satisfaire toutes catégories de requérants, et son coût demeure contrôlé. Description du procédé de dégagement des traits dans les combinés cadastre/orthophoto et d'un processus d'établissement d'une carte thématique polychrome à l'aide d'une seule couche d'arrachage.

Compte tenu des besoins de la région, le système utilisé en Alberta donne satisfaction; la mise-à-jour est prévue et s'effectue au rythme de la poussée des besoins. La souplesse du système permet l'utilisation de l'équipement et des matériaux les plus modernes, la modification des conventions de représentation, et un accroissement progressif du degré de mécanisation dans les travaux de rédaction. Enfin le système se prête à la confection de banques de données.

Introduction

The Canadian population of only 21,568,310 (1971 Census) lives mainly in widely separated centres spanning approximately 5,500km between the Atlantic and the Pacific. Ten Provinces and two Territories being relatively autonomous, tend to decentralize government and commerce, leaving sufficient room for a free and competitive development in methods and techniques in various fields of endeavor. As these techniques are being developed and applied, practical solutions seem to find a broad acceptance relatively fast, with or without modifications. The same applies to material and equipment.

Developing techniques relate often to the availability of materials or things, and as is the case in Alberta, exisiting individual subdivision plans are often well monumented and recorded. They lack only "A Common Monumented Reference Grid." Although subdivision plans were tied to the astronomically oriented township survey, it does not suffice todays requirements. Moreover, urban development has destroyed most monuments of the basically rural survey system. It appears therefore economical to utilize this readily available survey data and the existing compiled plans to their maximum.

It seems also important to have the final product fulfill certain basic requirements. Mainly, the horizontal and vertical survey control system should incorporate and correlate all existing data to build a strong, accurate reference grid, which will be capable of being utilized for all future developments.

The system should preferably be uniform, not only on a provincial, but also on a national and possibly on an international basis. Compiled plans, maps or other graphical display, based on such a system, should satisfy the widest range of individuals or organizations. They should be compatible so that an exchange or utilization through various combinations, in any form, are easily accomplished. Data stored and recalled as graphical overlay could easily fit an existing base map. The system should also be flexible to allow future improvements and modifications. The quality of a product based on such a system should attract users in the widest possible sense, and if we could convince users to transfer graphically planned data, digitized from such a map to the ground, we would be close to an integrated system.

Scale Structure 1:25,000 - 1:5,000 - 1:1,000

The largest scale "National Topographic System Maps", available for only five major cities in Alberta, is at a scale of 1:25,000. Guided by the thought to compile only once and derive intermediate scales photographically through reductions or enlargements if absolutely required, it was felt that the compilation scale of 1:5,000 and 1:1,000 would suffice.

Size of Map Sheet

By consulting various municipal engineering departments, and also considering that 36" is a common film and diazo paper roll width, a 71 x 92 cm size has been chosen and could be changed to fit the B1 format.

The area covered by each map sheet is 4,000 by 3,000 meters at the 1:5,000 scale and 800 by 600 meters at the 1:1,000 scale.

Projection and Numbering System

The projection adopted is known as the conformal three degree transverse mercator projection, with a scale factor of 0.9999 and without a false easting. Transformation formulas for one zone can be used for all zones. The name transverse mercator projection could be misleading as it was introduced by J. H. Lambert in 1772. Fifty years later, in 1822, Gauss published the analytic derivations for it, and in 1912 Kruger developed formulas suitable for numerical calculations. (Reference 1).

Each 1:5,000 map sheet receives the significant figures of the co-ordinates of the lower right corner as the identifier together with the city, town or village name.

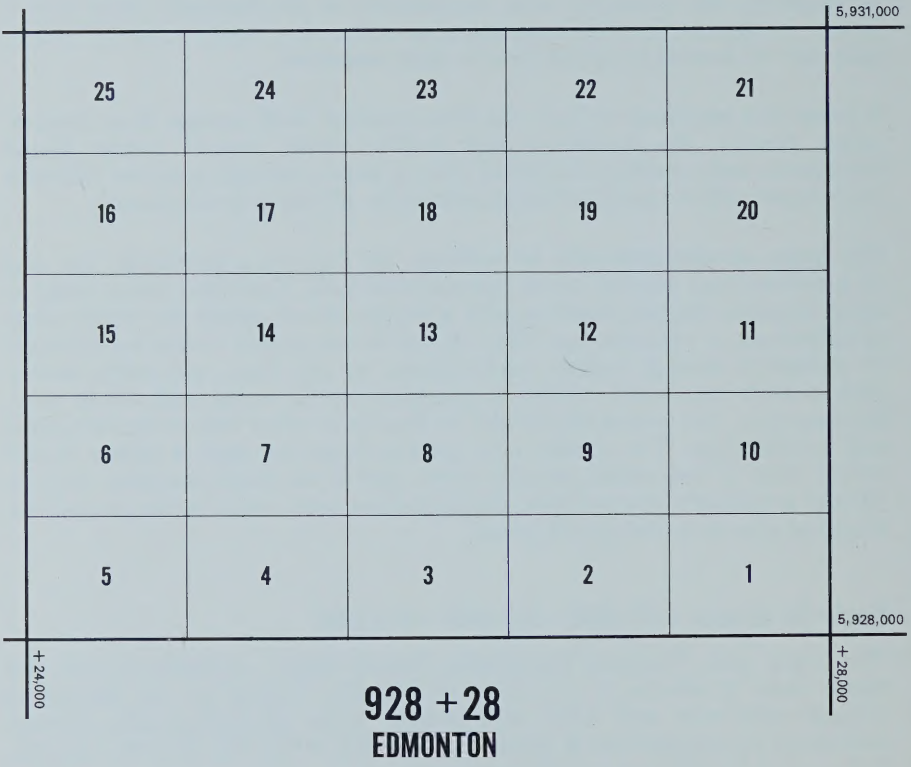


Figure 1

The 1:1,000 series divides the 1:5,000 map sheet into 25 units. **Figure 1** indicates that the lower right corner of map sheet 928 + 28 Edmonton has a northing of 5,928,000 m referred to the equator and is 28,000 m east of the reference meridian 114 degrees. A two colour index map has been printed to aid in the identification of map sheets.

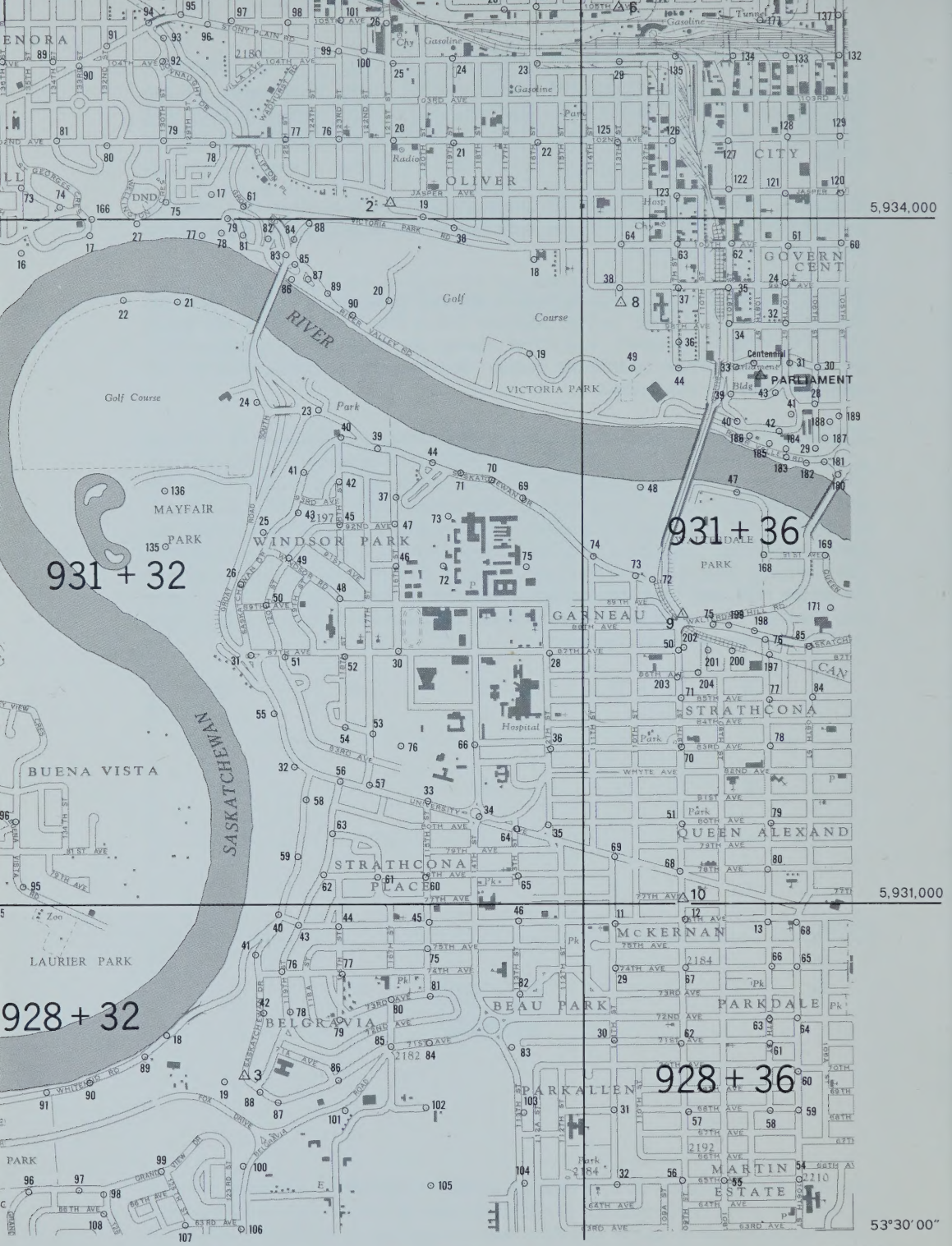
Control Survey Index Map 1:25,000

For the purpose of identifying and locating control survey monuments, we are publishing a two colour index map. The base map is offset printed in grey, and the control monuments, together with the 1:5,000 grid and numbering system, in red.

[**Figure 2**] Provisional editions are diazo printed from a clear film positive combination of a 60% screen tinted base and a solid type and line work of the control survey information.

[**Figure 3**] The base of the index map is derived from the 1:25,000 "National Topographic System Map" or the "Military Town Plan" where these are available. The map is up-dated, and street casings are widened to accommodate the type for the street numbering system. Section and township numbers are added in areas not subdivided.

[**Figure 4**] The red overlay, containing control survey monuments, the 1:5,000 grid and numbering system, is produced as follows: Monuments are plotted on a white and rust scribe coat from IBM punched cards, along with all corners for each 1:5,000 map sheet. The plotting is done with a Zeiss Coordimat and circular symbols are automatically scribed, while triangles around each centre dot are hand-scribed, utilizing a template. The line work is scribed by connecting automatically engraved dots by hand. Waxed phototype is added directly to the scribe coat and later photographed through reflected light, with a black film backing. The result is the final printing negative for the red overlay, right reading emulsion down in one step.



CONTROL SURVEY INDEX

SCALE 1:25,000

I AND II ORDER MONUMENTS.....△

III ORDER MONUMENTS.....○

Figure 2

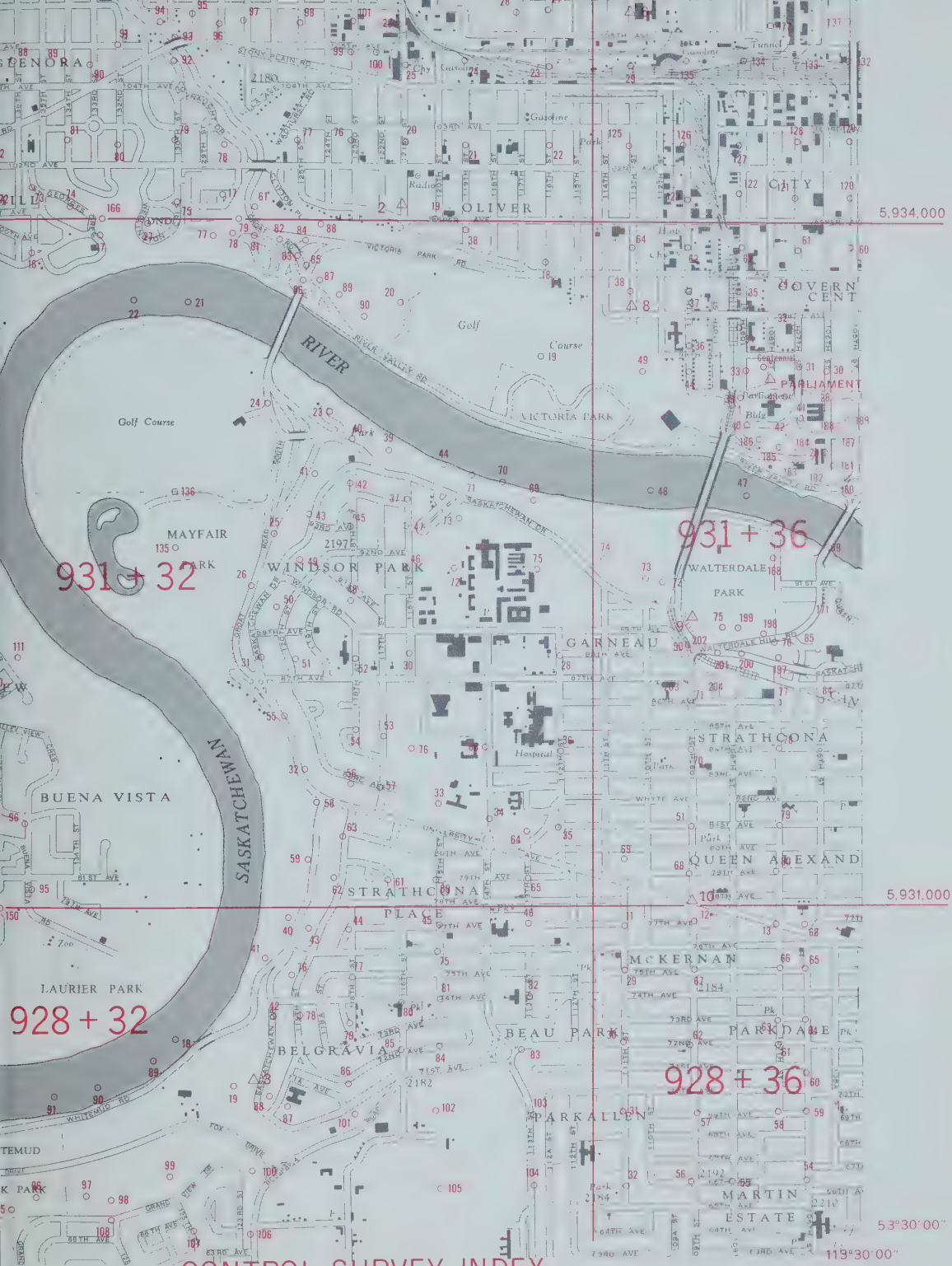

5,934,000
5,931,000
53°30'00"
113°30'00"
931 + 32
931 + 36
928 + 32
928 + 36
RIVER
SASKATCHEWAN
VICTORIA PARK
WINDSOR PARK
MAYFAIR
WALTERDALE
PARK
GARNEAU
STRATHCONA
BUENA VISTA
LAURIER PARK
BELGRAVIA
PARKALLEN
MCKERNAN
PARKDALE
MARTIN
ESTATE
OLIVER
CITY
GOVERNMENT
PARLIAMENT
Golf Course
Hospital
Zoo
CONTROL SURVEY INDEX
SCALE 1:25,000
I AND II ORDER MONUMENTS.....△
III ORDER MONUMENTS.....○

Figure 3

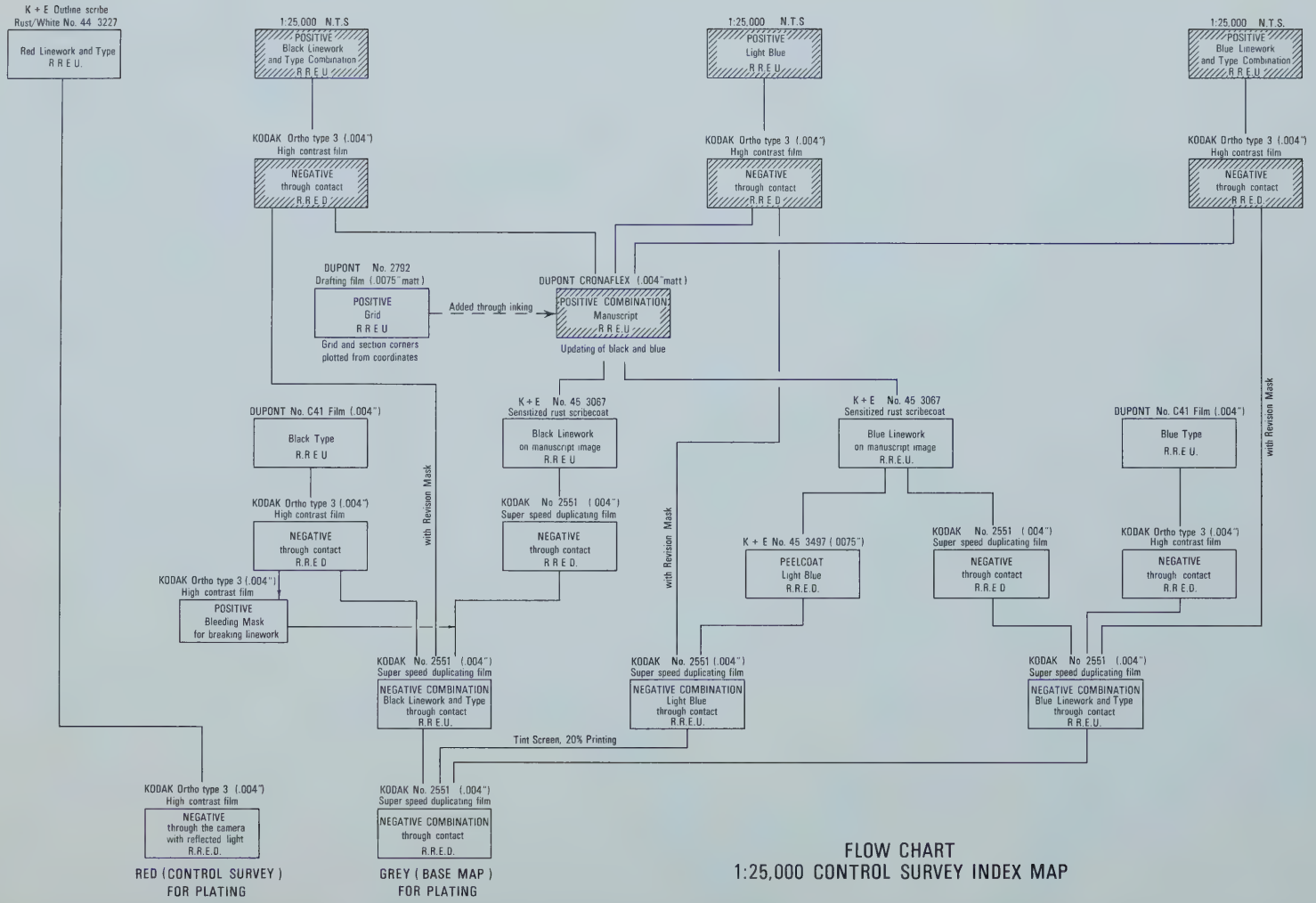

K + E Outline scribe
Rust/White No. 44 3227
Red Linework and Type
R R E U.
1:25,000 N.T.S
POSITIVE
Black Linework
and Type Combination
R R E U
KODAK Ortho type 3 (.004")
High contrast film
NEGATIVE
through contact
R R E D
1:25,000 N.T.S
POSITIVE
Light Blue
R R E U
KODAK Ortho type 3 (.004")
High contrast film
NEGATIVE
through contact
R R E D
1:25,000 N.T.S.
POSITIVE
Blue Linework
and Type Combination
R R E U
KODAK Ortho type 3 (.004")
High contrast film
NEGATIVE
through contact
R R E D
DUPONT No. 2792
Drafting film (.0075" matt)
POSITIVE
Grid
R R E U
Grid and section corners
plotted from coordinates
Added through inking
DUPONT CRONAFLEX (.004" matt)
POSITIVE COMBINATION
Manuscript
R R E U
Updating of black and blue
DUPONT No. C41 Film (.004")
Black Type
R R E U
KODAK Ortho type 3 (.004")
High contrast film
NEGATIVE
through contact
R R E D
with Revision Mask
K + E No. 45 3067
Sensitized rust scribecoat
Black Linework
on manuscript image
R R E U
KODAK No 2551 (.004")
Super speed duplicating film
NEGATIVE
through contact
R R E D.
K + E No. 45 3067
Sensitized rust scribecoat
Blue Linework
on manuscript image
R R E U.
with Revision Mask
K + E No. 45 3497 (.0075")
PEELCOAT
Light Blue
R R E D.
KODAK No. 2551 (.004")
Super speed duplicating film
NEGATIVE
through contact
R R E D
DUPONT No. C41 Film (.004")
Blue Type
R R E U.
KODAK Ortho type 3 (.004")
High contrast film
NEGATIVE
through contact
R R E D.
with Revision Mask
KODAK Ortho type 3 (.004")
High contrast film
POSITIVE
Bleeding Mask
for breaking linework
KODAK No. 2551 (.004")
Super speed duplicating film
NEGATIVE COMBINATION
Black Linework and Type
through contact
R R E U.
KODAK No. 2551 (.004")
Super speed duplicating film
NEGATIVE COMBINATION
Light Blue
through contact
R R E U.
KODAK No. 2551 (.004")
Super speed duplicating film
NEGATIVE COMBINATION
Blue Linework and Type
through contact
R R E U.
Tint Screen, 20% Printing
KODAK Ortho type 3 (.004")
High contrast film
NEGATIVE
through the camera
with reflected light
R R E D.
RED (CONTROL SURVEY)
FOR PLATING
KODAK No. 2551 (.004")
Super speed duplicating film
NEGATIVE COMBINATION
through contact
R R E D.
GREY (BASE MAP)
FOR PLATING
FLOW CHART
1:25,000 CONTROL SURVEY INDEX MAP

Figure 4

Manuscripts for the 1:1,000 Cadastral Series

The first step in mapping is the compilation of a manuscript. The scale we have chosen is 1 inch to 100 feet, as the largest percentage of existing plans are readily available at this scale, others are photographically enlarged to it.

The approximate location of each map sheet grid is graphically determined from the 1:25,000 index map, and the plans, black line diazo prints, are spliced accordingly. In addition, the positions of two or more control monuments are plotted from field ties onto the manuscript. From these, the nearly true position of the map sheet boundaries are determined.

When the cities of Edmonton and Calgary required centroid coordinates within a short period of time, for data bank purposes, I suggested the conversion of all existing compiled subdivision plans in a similar manner.

The spliced plan is then photographed and the negative is retouched to eliminate unwanted information and soiled background. Through contact, a matt positive is obtained. All survey plans are located. Where necessary, title searches are made to clarify property boundaries. Registered plan outlines and numbers are marked, necessary corrections, additions or deletions are made.

Diazo prints of the completed manuscripts [**Figure 5**] and prints of all registered or filed plans are then passed on to the Control Survey Section for field ties.

Field Ties and Calculation of Co-ordinates

Manuscripts are examined with emphasis on structure and extent of each subdivision. Field ties are made from the control stations to strategic points, and co-ordinates calculated. Utilizing this skeleton, computations are carried through each plan of survey, generating co-ordinates of block corners, curve centres and other deflection points. The co-ordinates, together with all registered plan dimensions, are then input to a computer programme which derives co-ordinates for each lot corner. This process also provides a verification of all previously calculated co-ordinates by making bearing and distance comparisons with the legal survey plans.

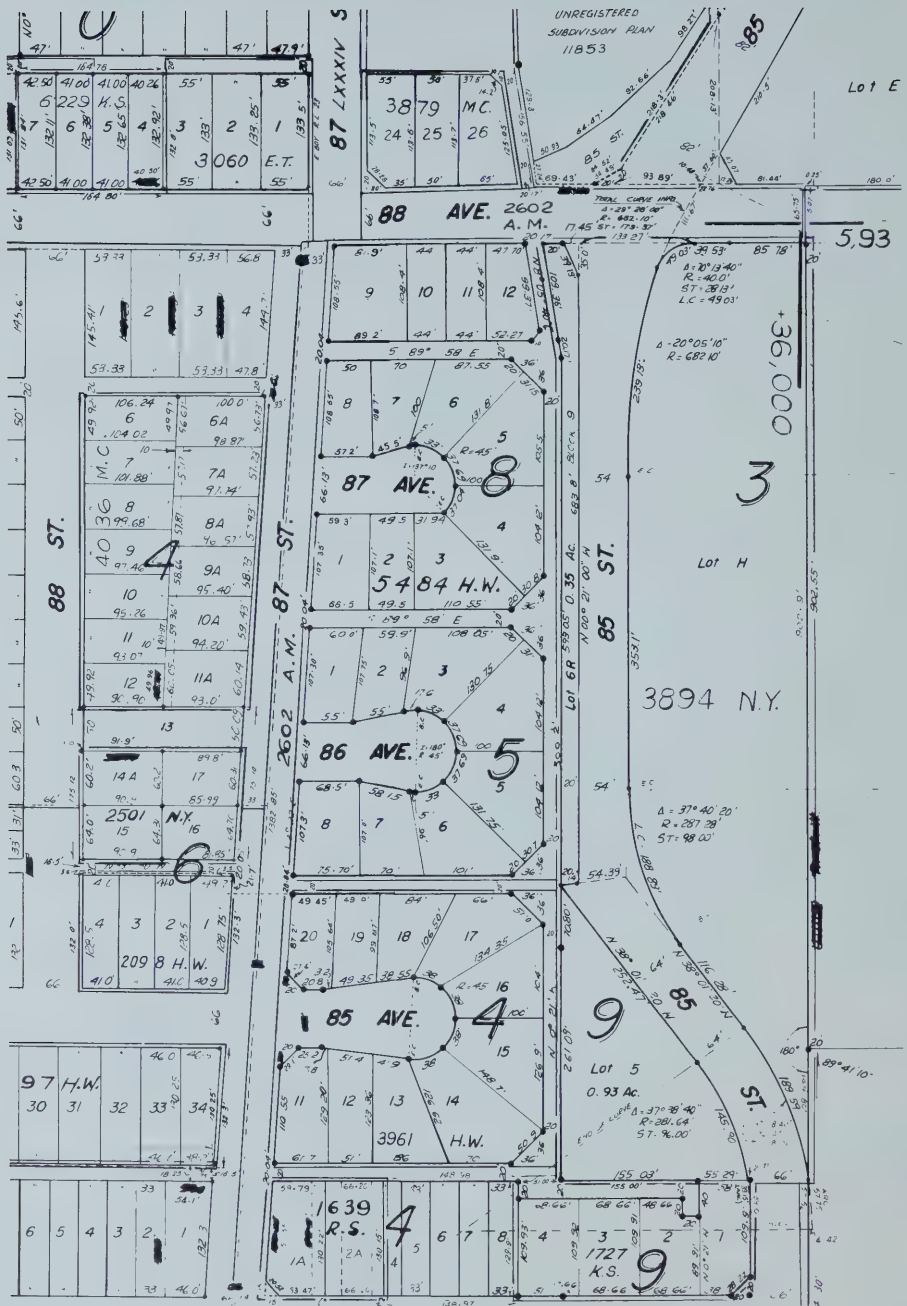

UNREGISTERED SUBDIVISION PLAN 11853
88 AVE.
87 AVE.
86 AVE.
85 AVE.
88 ST.
87 ST.
85 ST.
2602 A.M.
3060 E.T.
6229 K.S.
3879 M.C.
5484 H.W.
3894 N.Y.
2501 N.Y.
2098 H.W.
3961 H.W.
1639 R.S.
1727 K.S.
97 H.W.
Lot E
Lot H
Lot 5
0.93 Ac.
Lot 6R
0.35 Ac.
5,93
3,000+

Figure 5

THE 1:1,000 MAP

Field ties and calculations completed, the Control Survey Section returns a copy of the manuscript with numbered cadastral stations, a set of sorted IBM cards with station numbers and co-ordinate values and a list of these to the Mapping Office. [**Figures 6, 7, and 8**]. The list is divided into sections of confirmed and unconfirmed values, a list of control monuments together with punched cards had been received previously for the production of the 1:25,000 "Control Survey Index Map".

Image Generation

The image generation approach takes into account that areas for urban lots (parcels) are not required. Calculations are block oriented, and directional orientations for parcels are missing for a fully automated plotting of the image. Accordingly, we found it economical to use a semi-automated approach. For it we utilize a Zeiss Coordimat with a plotting range of 1.20 m by 1.20 m. Some of its characteristics are: numerous scale ratios, programme cards for the selection of required digits, plotting of plus and minus co-ordinates on one map sheet and skipping of points exceeding the plotting range. Although the coordimat was originally designed for pricking points or printing symbols, we have had it partly modified to hold scribing points and to have a rotation time selector. Single, double and triple wedge shaped scribing points, made for rotational scribing, give a good selection of circular symbols or dots, which will photo-reproduce to perfection.

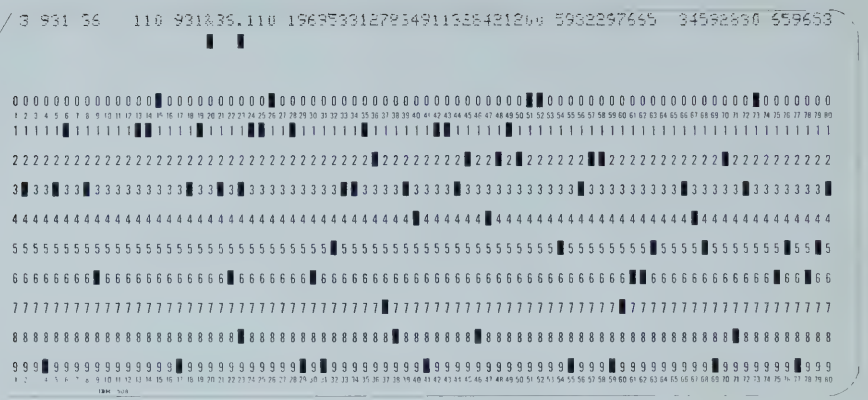
Punched cards are fed through a commercial IBM 545 punch, additional co-ordinates are set manually if required, using a setting mechanism in the control cabinet. The result, on a white and rust scribe coat, shows the outer map sheet boundaries, 20cm grid intersection crosses, symbols for all control monuments and cadastral stations, and dots for all other deflection points and lot corners. Points are also scribed within the overlap area to ensure a complete line work within the map sheet. These points will later be opaqued.

Using the manuscript as a guide, points are connected by hand. Arcs are scribed with a beam compass attached to a plotter and set at the centre of the circle.

Phototype is set with a Morisawa Electra MC 201 by Fairchild and transferred to a 3M translucent stripping film TS-5. A paraffin coating is applied, using a Diage Speedcote 1215. The finished product, known as transadhesive map type, is then composed directly onto the white and rust (double coated) scribe coat together with the engraved line work and symbols. This eliminates the separate type overlay and the necessary negative for a combination.

The finished map sheet, [**Figure 9**] shows lot and block numbers, registered plan lot dimensions, street names, numbers of survey control monuments and cadastral stations. The exterra shows the number and name of the map sheet, the scale, the number of the edition with date as well as a symbol and distance reference and co-ordinate values for the 20 cm grid.

The completed map sheet is compared with the manuscript, dimensions are manually scaled and discrepancies are clarified through additional computations or field ties if necessary.



3 DEGREE TRANSVERSE MERCATOR COORDINATES MERIDIAN 120 PAGE 1

CADASTRAL STATIONS ***** THEORETIC COORDINATES DERIVED THROUGH CALCULATION DATED 6 12 71 MAP SHEET 114 80 6

* NOTE * THE COMPLETE MONUMENT NUMBER IS FORMED BY PLACING THE MAP SHEET NUMBER, AS A PREFIX, ON THE CARD NUMBER FOR THIS MAP SHEET USE THE PREFIX 114 80.

MONUMENT NO CARD	FIELD	SURVEY DATE	LATITUDE D	M	S	LONGITUDE D	M	S	COORDINATES - FEET NORTHING	EASTING	COORDINATES - METRES NORTHING	EASTING
6001	HI 279/06	1971	0	0	0.0	0	0	0.0	20062929.879	251909.400	6115181.027	76791.985
6002	HI 034/06	1971	0	0	0.0	0	0	0.0	20062905.919	251789.150	6115173.724	76745.333
6003	HI 062/06	1971	0	0	0.0	0	0	0.0	20062904.570	251706.470	6115173.313	76720.132
6004	HI 089/06	1971	0	0	0.0	0	0	0.0	20062903.419	251636.490	6115172.962	76698.832
6005	HI 100/06	1971	0	0	0.0	0	0	0.0	20062895.459	251151.811	6115170.536	76551.072
6006	HI 101/06	1971	0	0	0.0	0	0	0.0	20062895.089	251129.291	6115170.423	76544.208
6008	HI 276/06	1971	0	0	0.0	0	0	0.0	20062820.659	250897.910	6115147.737	76473.683
6009	HI 277/06	1971	0	0	0.0	0	0	0.0	20062780.279	250104.111	6115135.429	76231.713
6010	HI 278/06	1971	0	0	0.0	0	0	0.0	20062458.510	249592.598	6115037.354	76075.824

END OF LIST

LOTCOR OUTPUT - IN SPECIAL FORM - BOTH PRINTED PAGE AND SORTED PUNCHED CARDS PAGE 1

CADASTRAL SHEET 114E80 14 REG PLAN LOT CORNERS E. FACTOR 0.999871 DATE 1 11 71

LINEAR ERROR OF CLOSURE 0.080 METERS 0.262 FEET
RELATIVE ERROR OF CLOSURE 1/ 2017

COMPUTED BEARING OF COURSE 89 2 35

CADASTRAL STATION	LOT CORNER	ACCUMULATED DIST - FEET	COORDINATES - FEET NORTHINGS	EASTINGS	ACCUMULATED DIST METRES	COORDINATES - METRES NORTHINGS	EASTINGS	CADASTRAL STATION
16001		0.00	20065006.61	251659.58	0.000	6115814.015	76718.888	16001
	50001	33.01	20065007.16	251702.59	10.062	6115814.183	76718.949	
	50002	77.03	20065007.71	251795.60	23.174	6115814.351	76719.009	
	50003	99.04	20065008.26	251763.60	30.186	6115814.519	76730.070	
	50004	132.05	20065008.82	251801.61	40.248	6115814.687	76749.131	
	50005	165.06	20065009.37	251834.62	50.310	6115814.855	76759.191	
	50006	198.07	20065009.92	251867.63	60.373	6115815.023	76769.252	
	50007	231.08	20065010.47	251900.63	70.435	6115815.191	76779.313	
	50008	264.10	20065011.02	251933.64	80.497	6115815.359	76789.373	
	50009	297.11	20065011.57	251966.65	90.559	6115815.527	76799.434	
	50010	330.12	20065012.12	251999.66	100.621	6115815.695	76809.495	
	50011	363.13	20065012.67	252032.66	110.683	6115815.863	76819.556	
	50012	396.15	20065013.23	252065.67	120.745	6115816.031	76829.616	
	50013	429.16	20065013.78	252098.68	130.807	6115816.199	76839.677	
	50014	462.17	20065014.33	252131.69	140.869	6115816.367	76849.738	
	50015	495.18	20065014.88	252164.69	150.931	6115816.535	76859.798	
17001		528.19	20065015.43	252197.70	160.993	6115816.703	76869.859	17001

Figures 6,7 & 8

Image Transformation

The double coated scribe coat with line work and type is then photographed with reflected light and a black film backing yielding a negative of both the line work and type. [**Figure 9**].

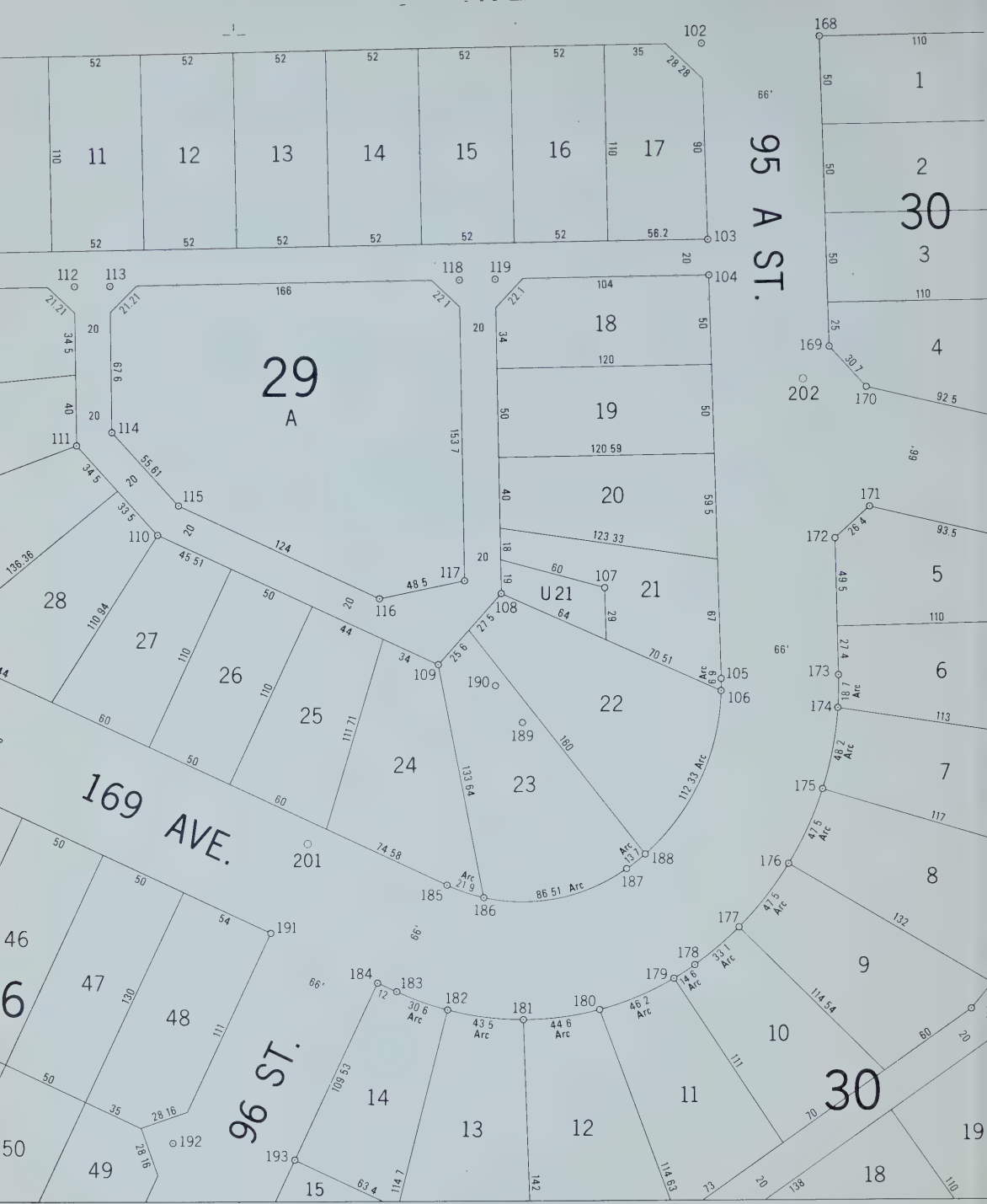
To obtain the line work only [**Figure 10**], which is used as a base for various engineering projects, such as road subdivision designs, utility records etc. the scribe coat is photographed through projected light. [**Figure 11, Flow Chart**]

Distribution

Film positives, negatives or prints are supplied to the Land Titles Offices and Municipalities for use as a cadastral or multi-purpose base map.

Revision

Newly registered survey plans are processed instantly, the manuscripts are updated, new co-ordinates are generated and the map sheet is revised.



△ I AND II ORDER MONUMENTS

◎ III ORDER MONUMENTS

o CADASTRAL STATIONS

Distances are in feet and are derived from registered plans

SCALE 1:1,000

3° T.M. Ref. Mer. 114° Scale Factor 0.9999

Figure 9

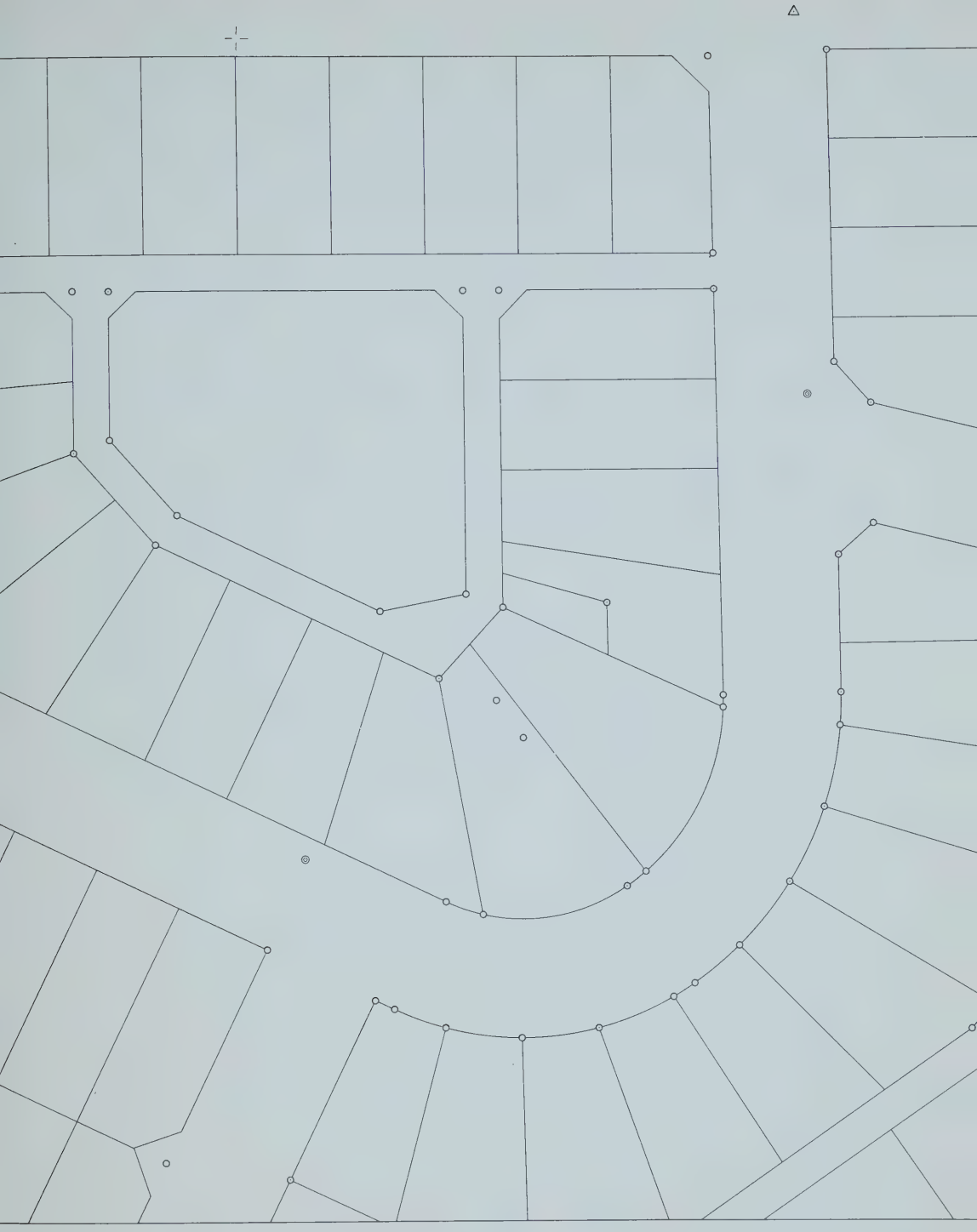
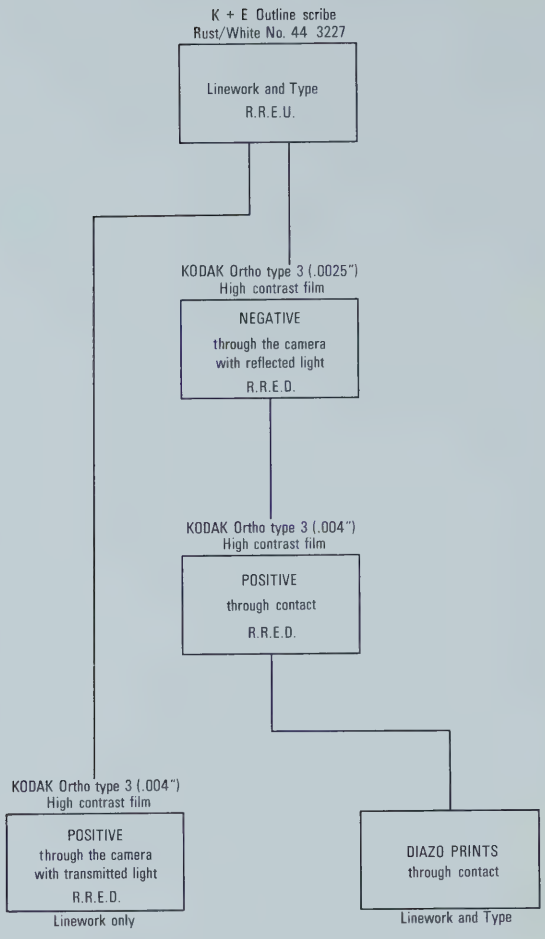

△ I AND II ORDER MONUMENTS
◎ III ORDER MONUMENTS
o CADASTRAL STATIONS
SCALE 1:1,000
3° T.M. Ref. Mer. 114° Scale Factor 0.9999

Figure 10



FLOW CHART
1:1,000 CADASTRAL MAP

Figure 11

Image Modification

I would like to introduce this terminology to broaden the utilization of not only large scale maps, but all map series. Any mapping system should have modification capabilities to derive from it special maps as required. If this is not the case, various agencies will build up their own mapping groups and create their own special maps, and thus duplicate parts of existing maps at an unnecessary expense.

Our first step in image modification is the ability to supply, from one original, the line work only or the line work with type, both in solid black or screen tinted as required.

Secondly, we have combined, on demand, cadastral maps (solid black) with topographic line work overlays (50% screen tinted black) for new subdivision planning purposes. [**Figures 12 and 13**]

Thirdly, on an experimental basis, we have produced a topographic overlay showing also a great number of utilities. This time the topography and the utilities are shown in solid black and the property boundaries are 50% screen tinted. [**Figure 14**]. A variation of illustrating utilities would be a clear film overlay, e.g. spectra diazo colour of 3M color key material, to be displayed in register with a cadastral base map. [**Figure 15**]

Fourthly, experimental combinations of cadastral and orthophotos have found much user interest. So that line work and type does not get lost within the highlights or shadows of a high contrast image, one can protect the emulsion of the combination halftone or continuous tone negative with a widened positive mask of the line work and type. This mask may be created through contact methods, using film spacers between the negative and positive or through camera, using a Klimsch line weight variomat. [**Figures 16, 17, & 18**]

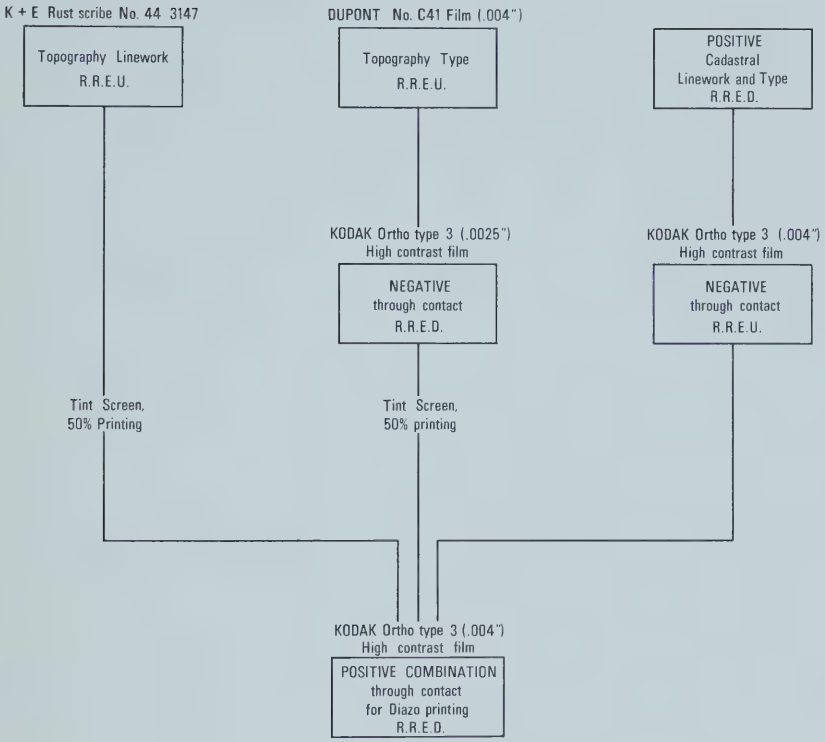
REFERENCE:

Surveyed line, with fence
wall, hedge or tree line
Hard surface road, sidewalk
Loose surface road
Cart track, trail
Railway
Bridge, culvert
Embankment, cutting
Outlined landmark area, park, cemetery
Building, under construction, ruin
Tank, silo, reservoir
Tower, radio, radar, micro-wave
Wall, fence, hedgerow

Pipeline, above ground, under ground
Pole, power or telephone
Pile, pit
Lake or pond, intermittent lake or pond
Streams, intermittent streams
Ditch
Rapids
Marsh or swamp
Contours
Depression contours
Approximate contours
Tree line, tree, wooded area
Spot elevation 228

Contour interval 2 feet,

Figure 12



FLOW CHART
1:1,000 CADASTRAL MAP WITH TOPOGRAPHY

Figure 13

GAS	G
WATER	W
SANITARY SEWER	SAN
STORM SEWER	STM
HYDRO CABLE POLE	H
TELEPHONE POLE	T
LIGHT STANDARD	L
FIRE HYDRANT	FH
MANHOLE	■
CATCH BASIN	B

1:1,000 CADASTRAL MAP WITH TOPOGRAPHY AND UTILITIES

Figure 14

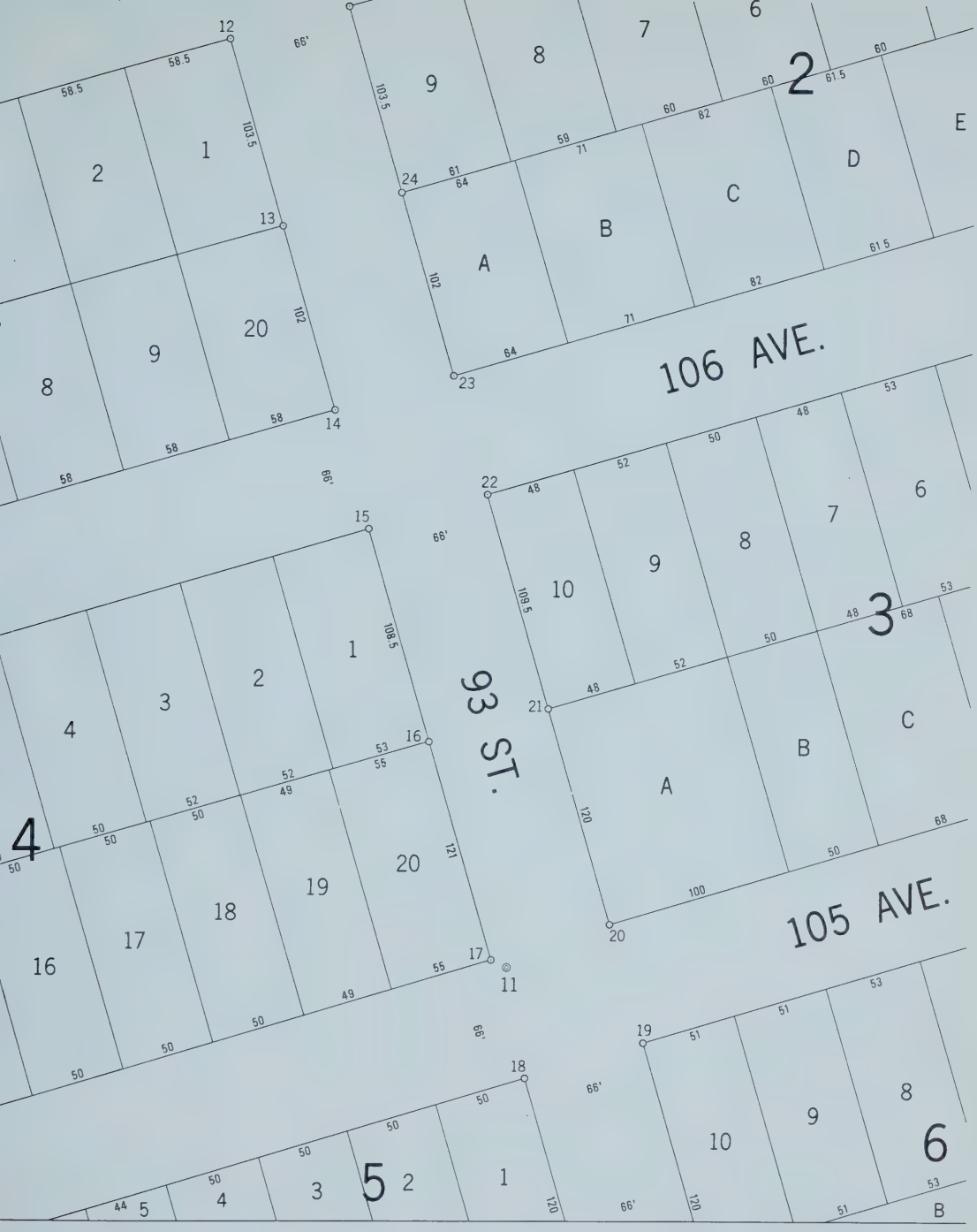
GAS
WATER
SANITARY SEWER
STORM SEWER
HYDRO CABLE POLE
TELEPHONE POLE
LIGHT STANDARD
FIRE HYDRANT
MANHOLE
CATCH BASIN

1:1,000 CADASTRAL MAP WITH UTILITIES

Figure 15

1:1,000 CADASTRAL MAP WITH TOPOGRAPHY AND UTILITIES

Figure 14

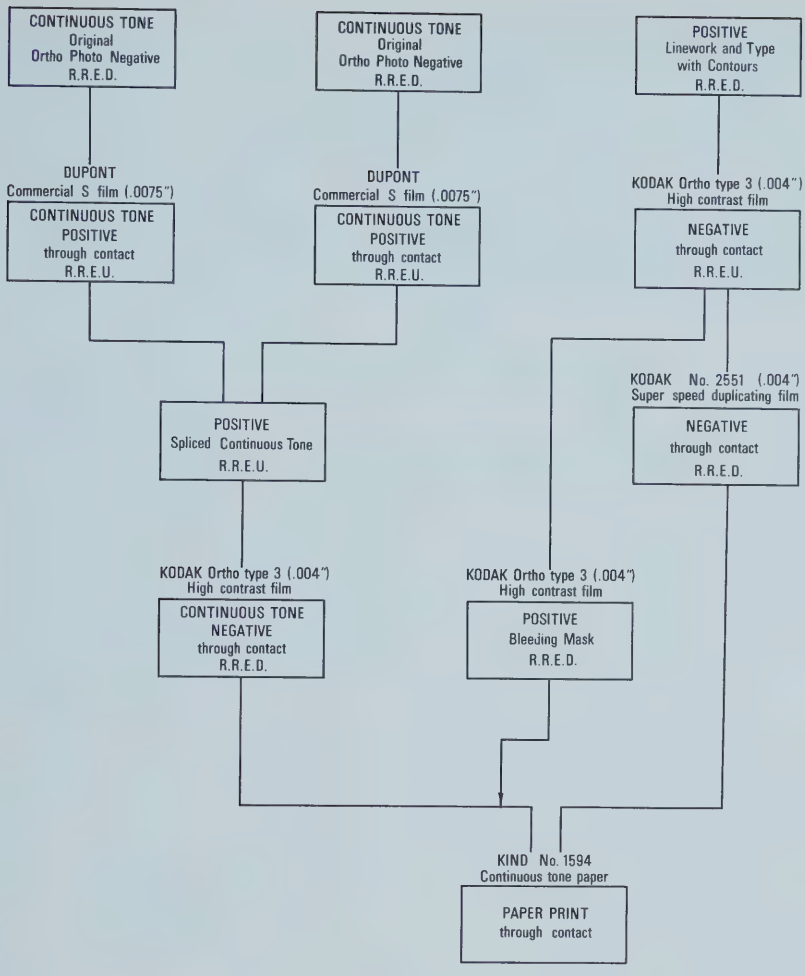


1:1,000 CADASTRAL MAP WITH UTILITIES

Figure 15

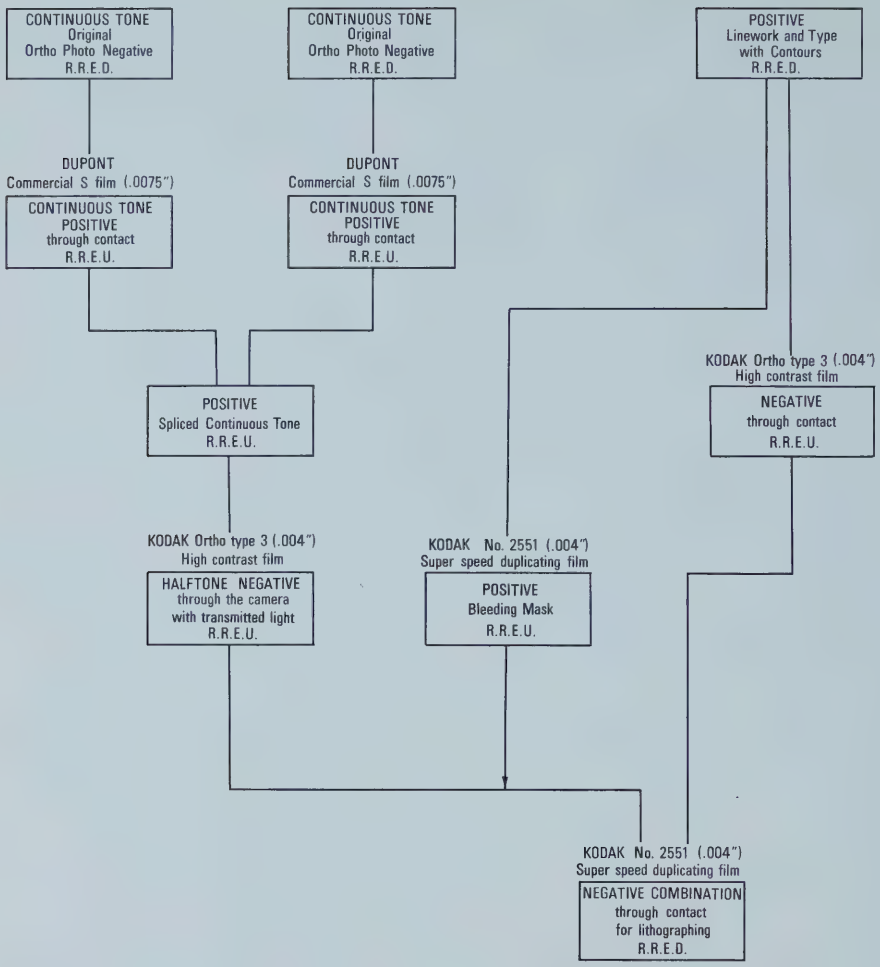
110
109 ST.
18
17
19
20
21
22
1
2
3
4
5
42
43
44
45
38
39
40
37
36
35
34
33
14

Figure 16



FLOW CHART
1:1,000 OR 1:5,000 CADASTRAL MAP
WITH CONTINUOUS TONE ORTHOPHOTO

Figure 17



FLOW CHART
1:1,000 OR 1:5,000 CADASTRAL MAP
COMBINED WITH HALFTONE ORTHOPHOTO

Figure 18

THE 1:5,000 MAP

Image Generation

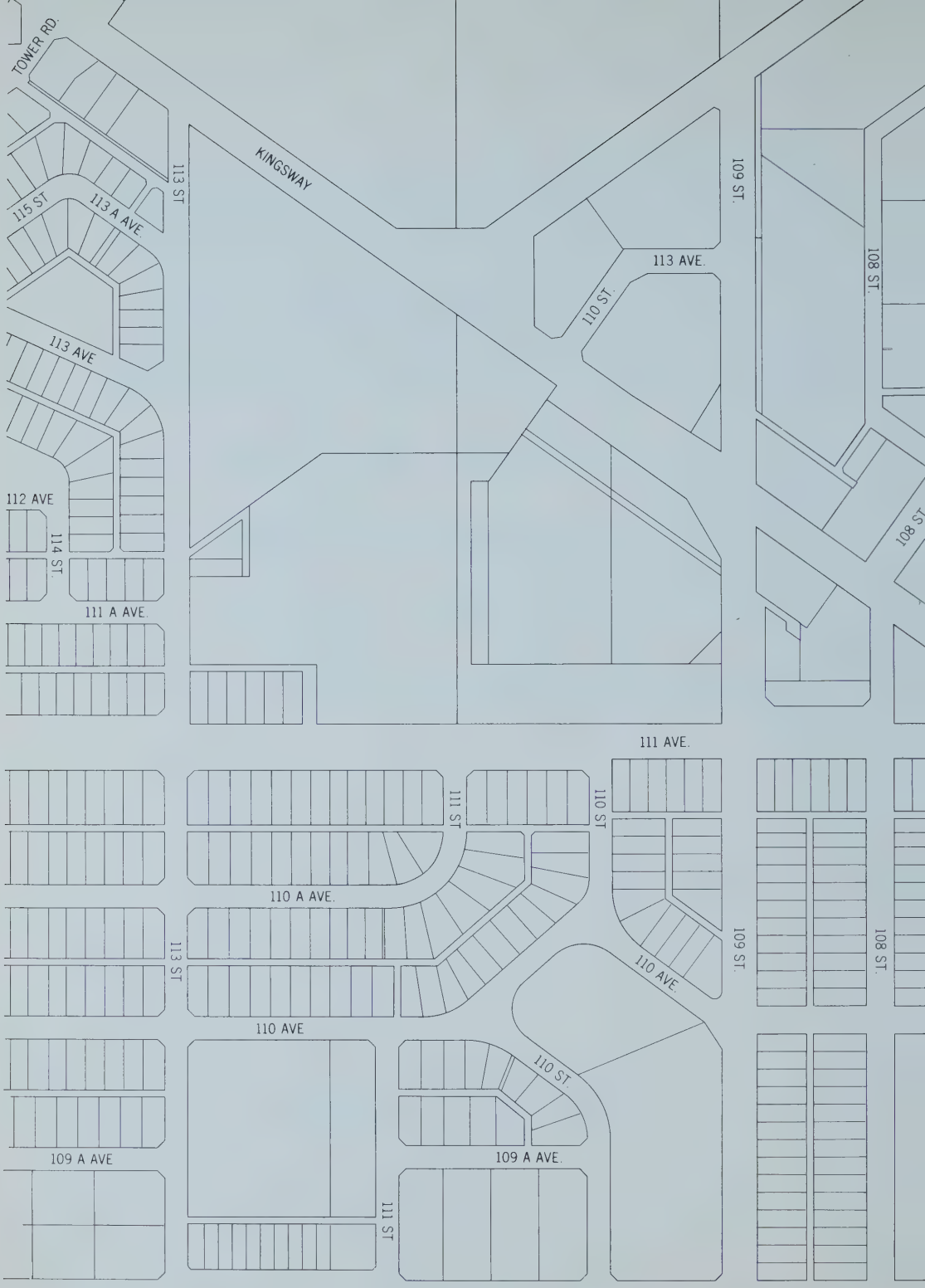
Although exceptions are made, a 1:5,000 map sheet will be generated only after completion of all 1:1,000 sheets within that area. Punched cards from that series are put in order for the plotting. As being done for the 1:1,000 series, these cards are fed into a 545 IBM Punch which senses as directed by program cards, the required digits and transfers these to the plotter control cabinet. The control cabinet, generating the necessary feed voltages, drives the motors of the coordimat connected to the measuring spindles and the scribing device. Single and multiple wedge shaped points engrave circular symbols or dots for the grid, survey control monuments, block and lot corners, miscellaneous deflection points and centres of circles. The scribed dot image is then duplicated onto a second scribe coat, using a wipe-on coating, for scribing of the lot boundaries only.

Clear film reductions of the 1:1,000 maps are used as manuscripts and serve also as a graphical check.

Points are connected by hand for half blocks, roads and miscellaneous parcels, excepting lot boundaries. Arcs are scribed with a beam compass attached to a plotter and set at the centre of each circle.

Transadhesive map type is composed on clear film as a separate overlay.

The completed components or overlays are: Scribe coat 1 with the complete line work for half blocks, scribe coat 2 showing all lot lines and the type composition.



SCALE 1:5,000

Figure 19

Image Transformation

A combination of the three aforementioned components yields the standard 1:5,000 map. [**Figure 19**]

Image Modification

Urban maps at the 1:5,000 scale seem to demand variations within the categories of cadastral, topographic and thematic maps.

Our first cadastral variation is a combination of scribe coat 1 (half-blocks) and type for the street system. [**Figure 20**]. This variation may also yield a 1:10,000 base map, when controlling the line weight with a variomat. [**Figure 21**]

The standard cadastral map may be enlarged to a scale of 1:2,500 under line weight control [**Figure 22**]. Another variation is the control survey index, having a screen tinted base. [**Figure 23**]

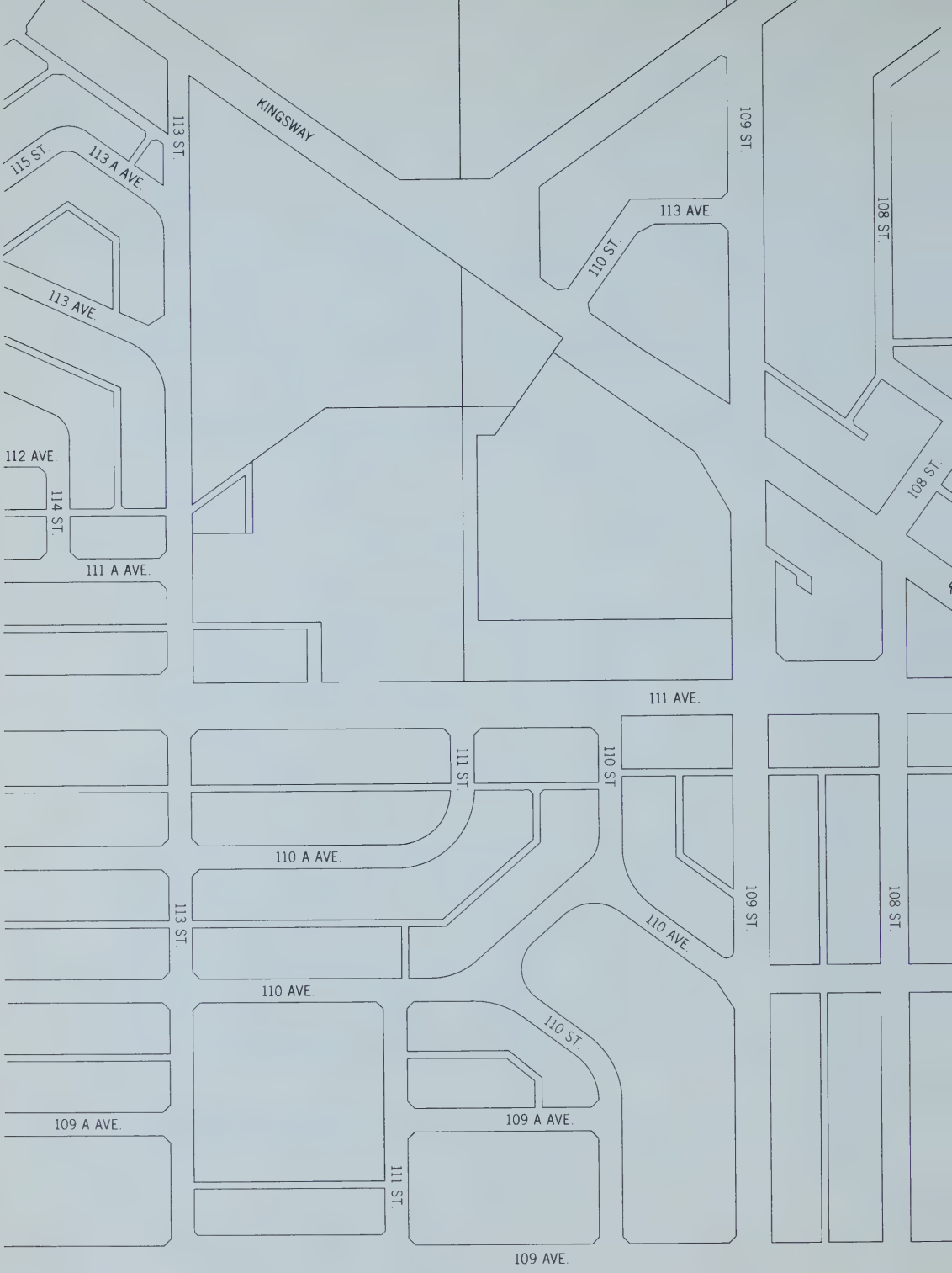
Capabilities to create topographic line maps, with or without a cadastral base, are most important and should satisfy a specific clientele.

A combination of a cadastral map with an ortho-photo base and a contour overlay has found a broad user interest, as the most versatile map. [**Figure 24**]. Revision of such a map would be economical and consist mainly of a new ortho-photo base, as the cadastral map is frequently up-dated in any event, and contours seldom change. A bold positive mask, with increased line weight, as described under the 1:1,000 series, could make line work and type visible even within the highlights or shadows of the continuous or halftone background.

To create variations within the third category, the thematic maps, both the cadastral or the topographic line map could be utilized as base maps.

Figure 25 is a sample of "Urban Land Use" in four basic colours. The base is a standard 1:5,000 cadastral map. The production approach is simple and economical, and would apply itself to numerous maps requiring colour tints. Each land use category (tint) is coded on a matt film positive. [**Figure 26**]. This positive will serve as a guide (underlay) for cutting a semi-translucent master mask under registration. After cutting and peeling all areas for code 1, a duplicate negative and a clear positive mask are made in contact, and code 2 and so on may now be cut and peeled. A clear film positive always has to mask prior codes or tints before exposing a new duplicate negative. [**Figure 27**]. This method has the added advantage of avoiding overlap of tints along each code boundary.

For "Flow Charts", illustrating the step-by-step production of the 1:5,000 series see **Figures 17, 18 and 28.**



SCALE 1:5,000

Figure 20

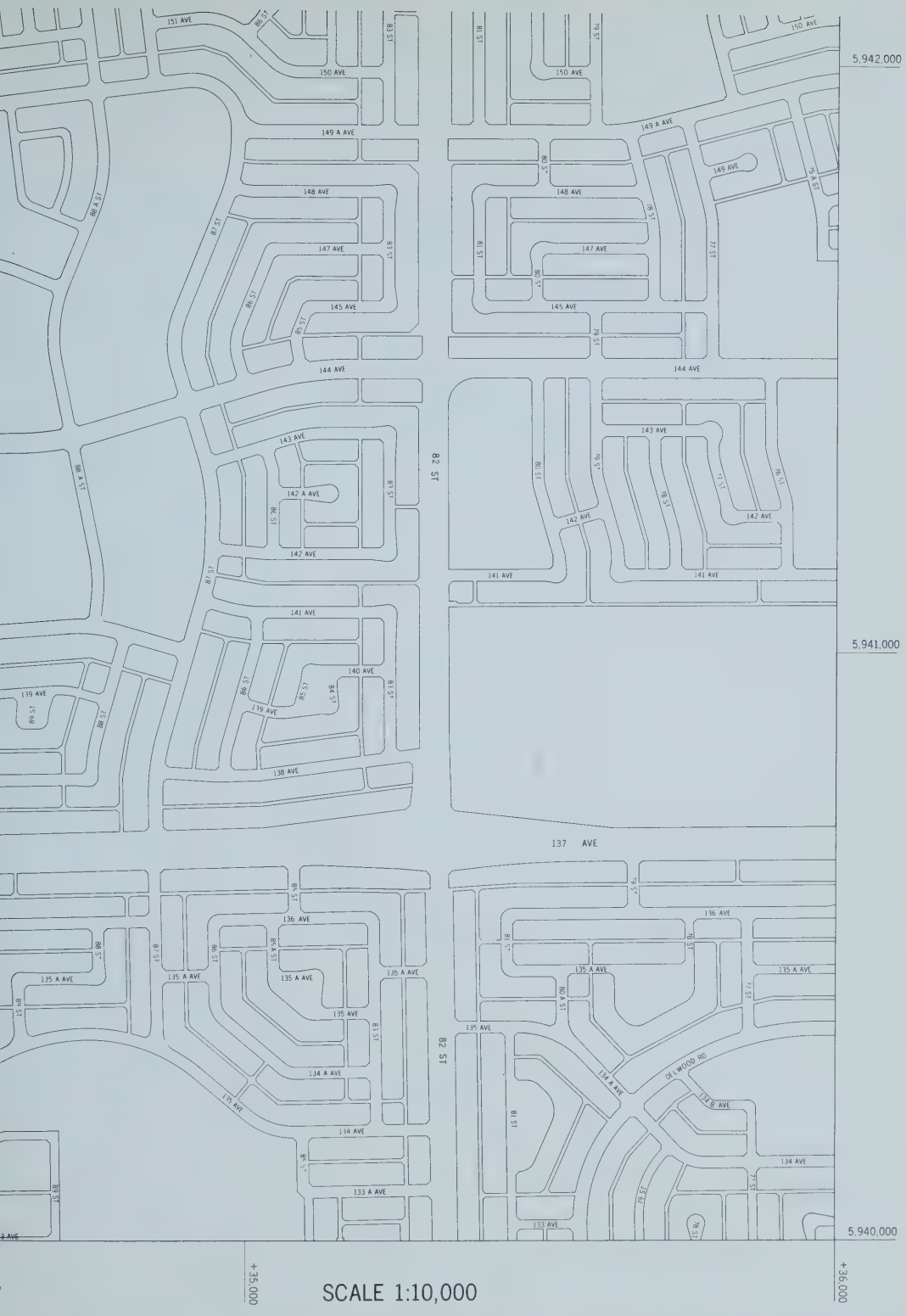
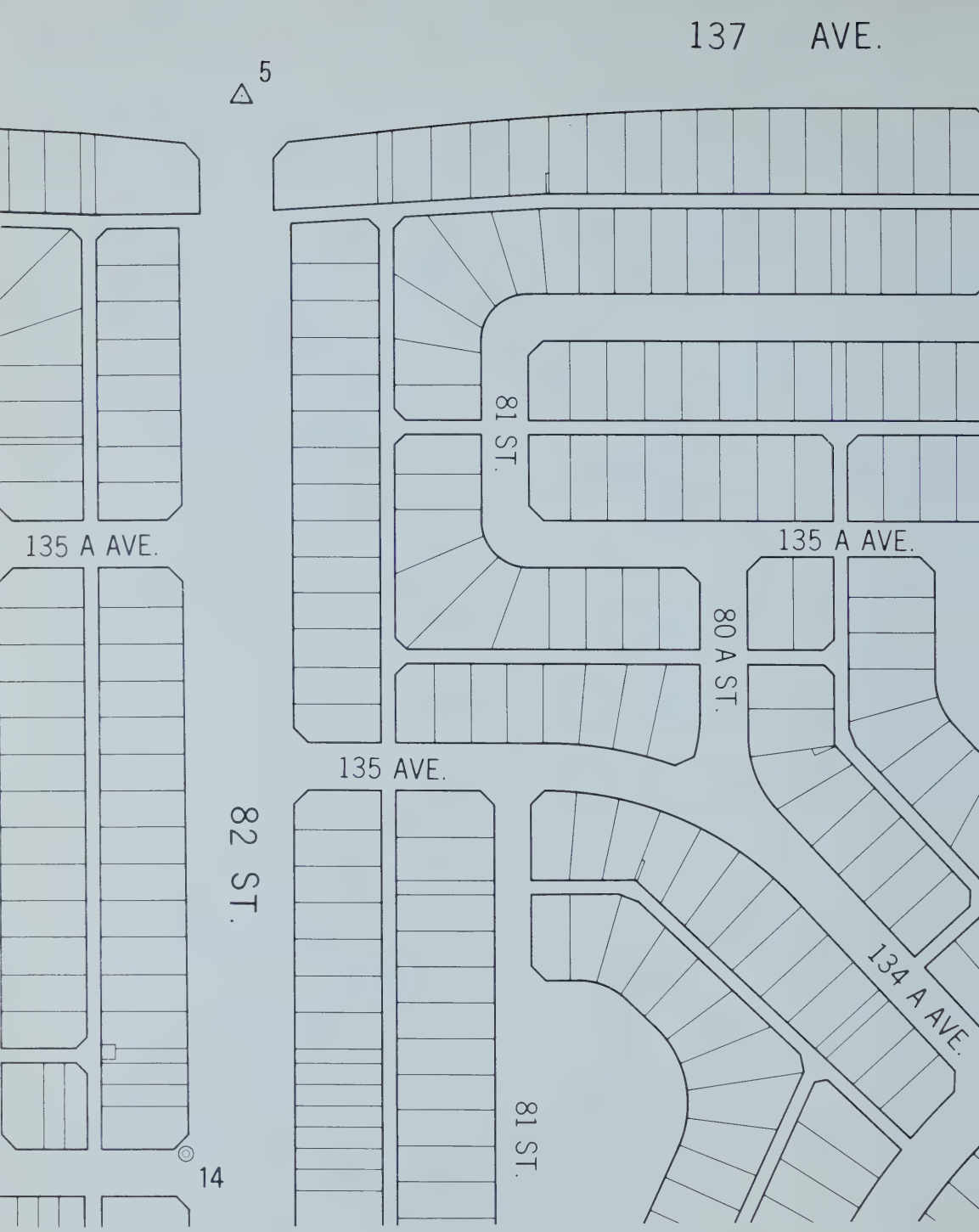

5,942,000
5,941,000
5,940,000
+35,000
+35,000
82 ST
137 AVE
151 AVE
150 AVE
149 A AVE
149 AVE
148 AVE
147 AVE
145 AVE
144 AVE
143 AVE
142 A AVE
142 AVE
141 AVE
140 AVE
139 AVE
138 AVE
136 AVE
135 A AVE
135 AVE
134 A AVE
134 AVE
133 AVE
OAKWOOD RD
SCALE 1:10,000
3° T.M. Ref. Mer. 114° Scale Factor 0.9999

Figure 21



△ I AND II ORDER MONUMENTS

◎ III ORDER MONUMENTS

SCALE 1:2,500

3° T.M. Ref. Mer. 114° Scale Factor 0.9999

Figure 22

SCALE 1:5,000

Figure 23

SHAND AVE.
103 ST.
104 ST.
SHAND AVE.
PINE PLAZA
102 AVE.
103 ST.
104 ST.
101 AVE.
HOPPE AVE.
99 ST.
100 ST.
99 AVE.
103 ST.
102 ST.
101 ST.
98 AVE.
104 ST.
105 ST.
103 A ST.
97 AVE.
4140
4100
4080
4060
4040
16
15
14
20
19
18
17

Figure 24

SHAND AVE.
PINE PLAZA
HOPPE AVE.
101 AVE.
99 AVE.
98 AVE.
103 ST.
102 ST.
101 ST.
100 ST.
99 ST.
98 ST.
104 ST.
15
16
17
18
19
20
URBAN LAND USE
I RESIDENTIAL
(a) Single Family
(b) Two Family
(c) Multi-Family
(d) Trailer Court
(e) Institutional Residence
II COMMERCIAL
III INDUSTRIAL
IV PUBLIC AND SEMI-PUBLIC
V RECREATIONAL
VI TRANSPORTATION AND COMMUNICATION
VII UTILITIES

Figure 25

URBAN LAND USE

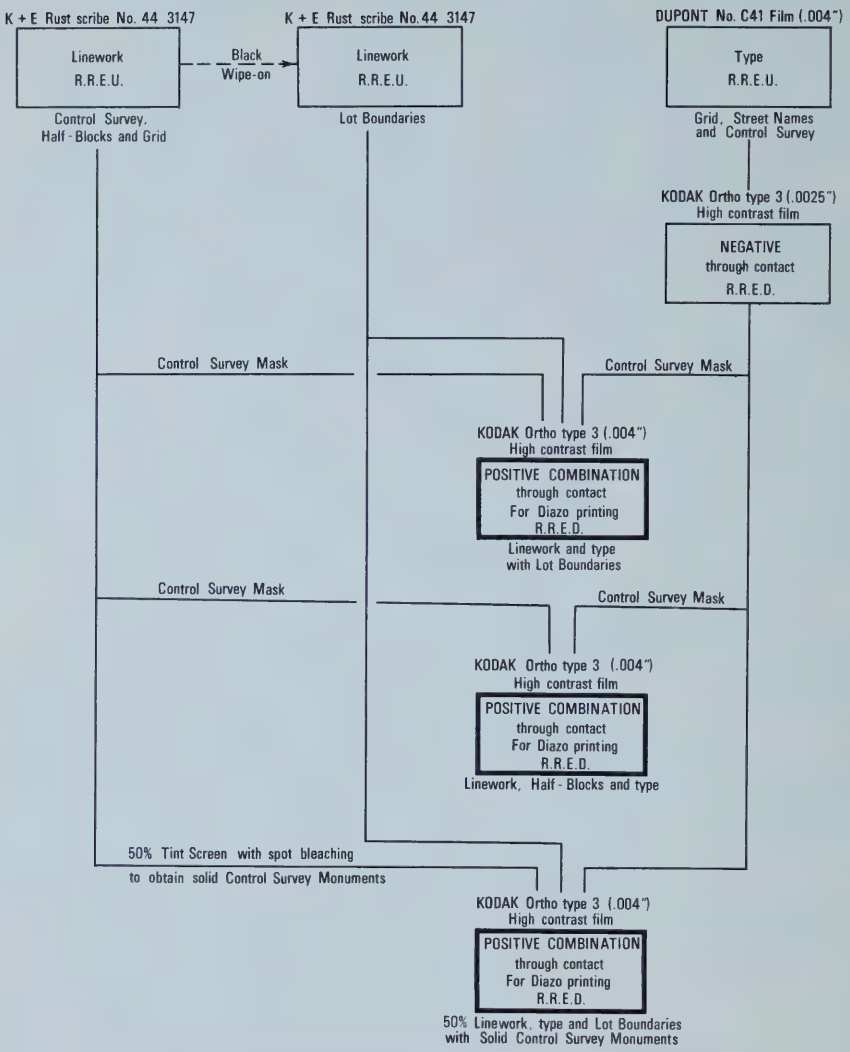
I RESIDENTIAL		III INDUSTRIAL	I
(a) Single Family	1	IV PUBLIC AND SEMI-PUBLIC	P
(b) Two Family	2	V RECREATIONAL	R
(c) Multi-Family	3	VI TRANSPORTATION AND COMMUNICATION	T
(d) Trailer Court	4	VII UTILITIES	U
(e) Institutional Residence	5		
II COMMERCIAL	C		

Figure 26

Figure 27

SHAND AVE
HOPPE AVE
100 ST
104 ST
98 ST
99
98
NE PLAZA
URBAN LAND USE
I RESIDENTIAL
(a) Single Family 1
(b) Two Family 2
(c) Multi-Family 3
(d) Trailer Court 4
(e) Institutional Residence 5
II COMMERCIAL C
III INDUS I
IV PUBL EMI-PUBLIC P
V RECRE R
VI TRAN ON AND COMMUNICATION T
VII UTILI U

Figure 26



FLOW CHART
1:5,000 CADASTRAL MAP

Figure 28

Time

The average 1:1,000 cadastral map requires 11 working days (7.25 hours per day) for the manuscript and 20 for the map itself. The annual average revision time amounts to 1.25 days per sheet. This combines to a factor of **6.9** map sheets per man year.

Field ties require 4 days, computations 8 days and annually 1 day for revision combine to a factor of **17** map sheets per man year in addition to the above.

The average 1:5,000 cadastral map requires 63.5 working days and an annual revision time of 4.5 days. The combined factor is **3.3** map sheets per man year.

The 1:25,000 Control Survey Index map requires 26 working days and 3 days of annual revision time per map. The combined factor is 7.6 maps per man year.

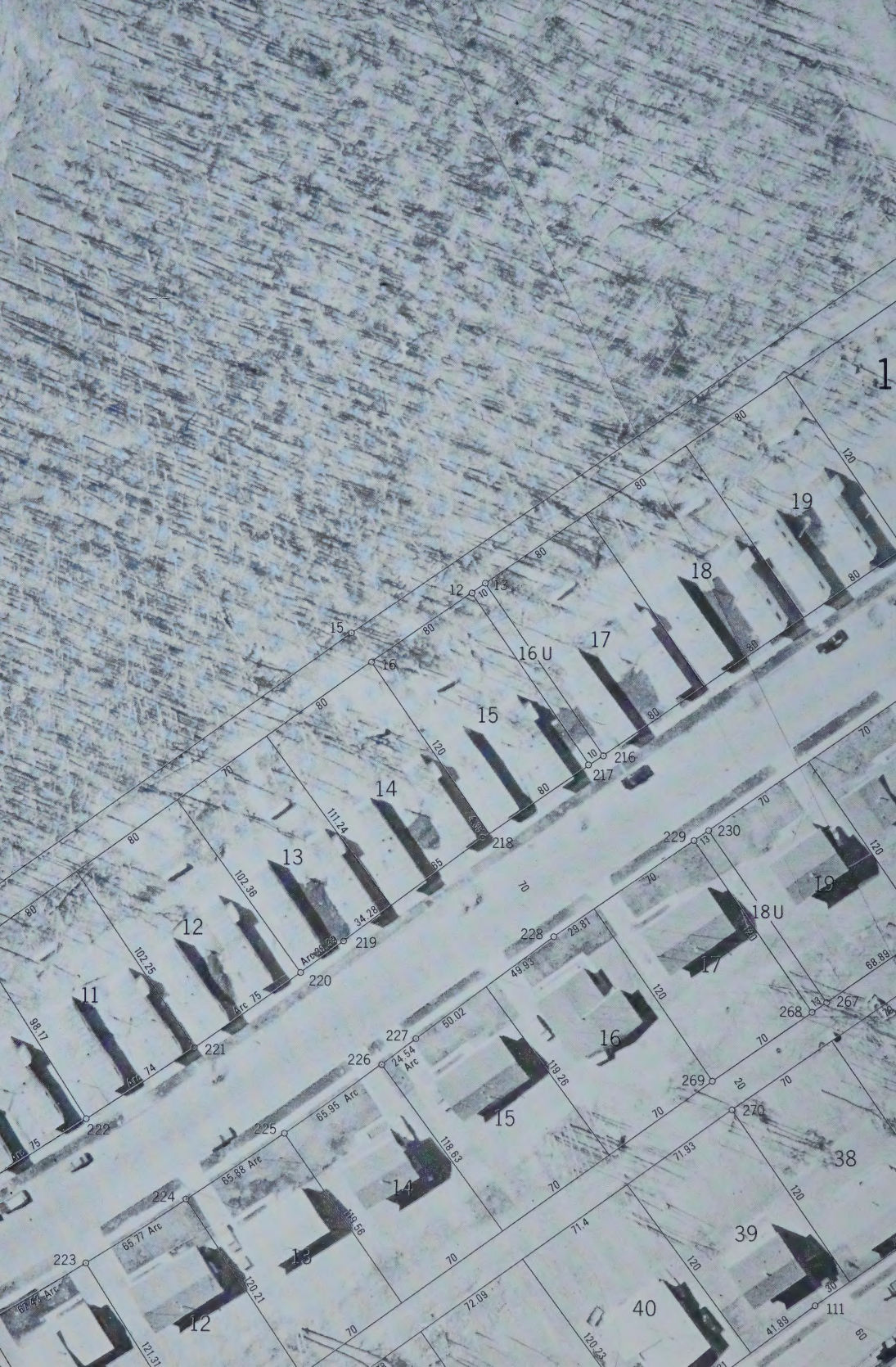
Conclusion

Considering local requirements and making allowances for the availability of man-power, equipment and materials, the chosen approach to Urban Mapping in Alberta appears practical and result oriented. Revisions are easily carried out. The system is capable of utilizing new materials and equipment, allows for variations in graphical requirements and greater computer assistance. If required, this system could form a tremendous graphical data bank.

A provincial study of land-related information systems is presently undertaken to identify "Land Use Classification and Coding", "Location Identifiers" and "Requirements for Land-Related Information in Alberta". Manipulated data from such systems could in future produce urban manuscripts or map components.

References

1: P. D. Thomas, 1952 "Conformal Projections in Geodesy and Cartography."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111.24
102.38
102.25
98.17
34.28
Arc 75
Arc 74
Arc 75
50.02
74.54 Arc
65.95 Arc
65.88 Arc
65.77 Arc
65.44 Arc
49.93
29.81
68.89
119.26
119.63
119.56
120.21
71.93
71.4
72.09
120.23
41.89
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